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EMISSION INVENTORY
CAPITAL DISTRICT (NEW YORK) AIR QUALITY MAINTENANCE AREA

by

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Contract No. 68-02-2314

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THIS PROJECT PROVIDES A DISAGGREGATED PARTICULATE AND SULFUR DIOXIDE EMISSION INVENTORY SUITABLE FOR USE IN BOTH BASE YEAR AND PROJECTION YEAR MODELING REQUIRED FOR THE CAPITAL DISTRICT AIR QUALITY MAINTENANCE AREA. THE ALLOCATION AND PROJECTION METHODOLOGY IS ESSENTIALLY THAT OF VOLUMES 7 AND 13 OF THE GUIDELINES FOR AIR QUALITY MAINTENANCE PLANNING AND ANALYSIS SERIES PUBLISHED BY USEPA.

THE PUBLISHED REPORT CONTAINS COUNTY AND AQMA LEVEL ESTIMATES OF RESIDENTIAL AND NON-AUTOMOTIVE TRANSPORTATION EMISSIONS FOR THE BASE AND PROJECTION YEARS. IT ALSO INCLUDES THE EXPECTED GROWTH OR DECLINE OF COMMERCIAL AND INDUSTRIAL EMISSIONS.

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This report was furnished to the Environmental Protection Agency by the Capital District Regional Planning Commission, Albany, New York in fulfillment of Contract No. 68-02-2314. This report has been reviewed by the Air Branch, EPA and approved for publication. Approval does not signify that the contents necessarily reflect the views and policies of the Environmental Protection Agency, nor does mention of trade names or commercial products constitute endorsement of recommendation for use.

ABSTRACT

This project provides a disaggregated particulate matter and sulfur dioxide emission inventory suitable for use in both base year and projection year modeling required for the Capital District Air Quality Maintenance Area. The allocation and projection methodology is essentially that of Volumes 7 and 13 of the Guidelines for Air Quality Maintenance Planning and Analysis series published by the United States Environmental Protection Agency.

The published report contains county and AQMA level estimates of residential and non-automotive transportation emissions for the base and projection years. It also includes the expected growth or decline of the commercial and industrial emissions. Actual commercial and industrial emissions are not contained in this report due to possible changes in the New York State Department of Environmental Conservation base year emission estimates. UTM cell level data is stored in the files of the New York State Department of Environmental Conservation.

Due to the limited growth projected for the Capital District and the trend towards electric space heating, only the commercial area source emissions are expected to show significant growth over the next 25 years.

This report was submitted in fulfillment of Contract No. 68-02-2314 by the Capital District Regional Planning Commission under the sponsorship of the U. S. Environmental Protection Agency. This report covers the period May 1, 1976 to May 31, 1977, and work was completed as of May 31, 1977.

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CONTRACT NO. 68-02-2314
EMISSION INVENTORY BY UTM GRID CELL
CAPITAL DISTRICT (NEW YORK) AIR QUALITY MAINTENANCE AREA

INTRODUCTION

The New York State Department of Environmental Conservation is required to perform an analysis of the Capital District Air Quality Maintenance Area to insure that the ambient air quality will be maintained at a level that does not violate Federal Standards. Part of this analysis includes diffusion modeling of the Region's air quality with proposed pollution sources in operation. In order to properly perform this diffusion modeling, an inventory of air pollution emissions by UTM Grid Cell is required for the current year and for any future years to be analyzed.

The Capital District Regional Planning Commission has generated population land use and transportation data at the UTM Grid Cell level as part of its ongoing comprehensive planning efforts. The purpose of this contract is to transform CDRPC's data into the emission data required for input to the diffusion model. This is being done for two pollutants: Particulate Matter and Sulfur Dioxide.

GENERAL INFORMATION

CELL IDENTIFICATION - CDRPC does its computer planning work on the basis of UTM Grid cells. However, CDRPC's numbering system is such that a point to the south west of the Region is (0,0) and all numbers are less than 999, allowing a six digit coordinate identification. The first three digit number is the east-west number and the second is north-south. It is a simple matter to convert from CDRPC to UTM, however, as all of CDRPC's raw data is stored by CDRPC ID, all products generated in this contract give the CDRPC coordinate. When the data is combined for modeling, the following adjustments should be made:

555 should be added to the first three digits to get UTM Easting;
4692 should be added to the second three digits to get UTM Northing.

DATA AVAILABILITY - All computer programs and data files generated under this contract have been delivered to NYSDEC in paper copy form. Additionally, machine readable versions have been delivered to NYSDEC through the use of a special CDRPC mass storage file named AIR. AIR. was established by CDRPC and any data to be transferred is read into the AIR. file by CDRPC and used by NYSDEC. Due to the large amount of data generated under this project, DEC has asked CDRPC to store most data on computer tape to be retrieved, if necessary, at a future date. CDRPC has complied with this request.

A list of all programs and data files with a summary of their contents is contained at the end of this GENERAL INFORMATION Section. This information should allow interested persons to request copies of data elements or programs for inspection as required under 40FR51, section 51.62.

A complete dump of all AIR. files is a 6" thick stack of over 2000 pages costing over $80.00 to print. Therefore, due to the limited usefulness of such a dump, only one copy of most data exists. These copies have all been delivered to NYSDEC, and CDRPC does not intend to print such a dump again. If copies of specific programs or data files are necessary for the review of this work, they will be printed on request.

POPULATION AND ECONOMIC PROJECTIONS - When this project was initiated, CDRPC stated its intent to base all projections on CDRPC's Preliminary Regional Development Plan. The projections in the plan were consistent with Office of Planning Services Regional projections.

Since that time, the NYS Economic Development Board (EDB) has come up with new population projections (and by implication new economic projections) that result in a 1.3% higher SMSA level population in the year 2000, but a 10% lower AQMA population. A more detailed comparison of the figures is contained at the end of this subsection. CDRPC has not revised its Regional Development Plan to correspond to EDB's projections. However, CDRPC is consulting with its member counties during the plan refinement stage to arrive at mutually acceptable population projections for the small areas in the Region.

It is evident that the revised projections will be somewhere between CDRPC's Plan populations and EDB's projected populations. However, no hard numbers are available at this time. Therefore, CDRPC did all AQMA projection work with its Plan socioeconomic projections. It can be expected that any revised population projections will result in a more dispersed development pattern, and thus lower area source contributions to the hot spots.

Based on past experience, New York State can be expected to revise its projections for the Capital District almost every year. (Since 1974 the State has changed the Region's year 2000 population from 910,000 to 885,000 to 897,000). It is not practical or useful to redetail all of CDRPC's work every year based on these marginal changes in the total population. Therefore, the projections used in this report will be the most up to date ones available from CDRPC until after the Regional Development Plan consultation

process is complete, and the Plan is adopted.

COMPARISON OF CDRPC AND EDB COUNTY LEVEL POPULATION PROJECTIONS

	1970	EDB	10 Year % Growth	CDRPC	10 Year % Growth	Difference	%
			1980				
Albany	287000	293000	2.1	295500	3.0	+ 2500	0.9
Rensselaer	153000	160000	4.6	162800	6.4	2800	1.8
Saratoga	122000	169000	38.5	154700	26.8	-14300	-11.8
Schenectady	161000	158000	-1.9	166000	3.1	+ 8000	5.0
					Total	- 1000	
			1985				
Albany		296000		303700		+ 7700	
Rensselaer		164000		168400		+ 4400	
Saratoga		191000		165500		-25500	
Schenectady		157000		171400		+14400	
					Total	- 1000	
			1990				
Albany		299000	2.0	311900	5.5	+12900	3.5
Rensselaer		168000	5.0	174100	6.9	+ 6100	1.9
Saratoga		214000	26.6	176200	13.9	-37800	-12.7
Schenectady		159000	0.6	176800	6.5	+17800	5.9
					Total	- 1000	
			2000				
Albany		301000	0.7	330000	5.8	+29000	5.1
Rensselaer		175000	4.2	180000	3.4	+ 5000	- .8
Saratoga		259000	21.0	189000	7.3	-70000	-13.7
Schenectady		162000	1.9	186000	5.2	+24000	3.3
					Total	-12000	

CONTENTS OF PROGRAM AND DATA FILES USED IN THIS CONTRACT

Name	D - Data P - Program	Contents/Function
AIR1	P	Sorts through CDRPC File BLDBLK to obtain a list of the UTM cells in the communities in the AQMA. The output is AIR2 described below.
AIR2	D	A list of 2,143 cells in communities in the AQMA. The information on each cell is: CDRPC cell coordinate, CDRPC TAZ number, CDRPC subregion (not used in AQMA work), a 4-letter MCD name, and data not used in AQMA work.
AIR3	D	A list of the 401 TAZ's in the AQMA and their current and projected populations. Information contained is: CDRPC cell coordinate (for one cell in each TAZ), CDRPC TAZ number, 1970 census population, projected 1980, 1990 and 2000 populations.
AIR4	P	Uses AIR2 and AIR3 to divide the TAZ population evenly among the cells in the TAZ for each year. Output is AIR6 described below. AIR4 also indicates which TAZ's from AIR3 are not assigned to any cells so that the data may be manually edited.
AIR5	-	This name was used for many scratch files of non-permanent information. It contains no data not otherwise accounted for.
AIR6	D	This is the manually edited version of AIR6 containing all necessary hand corrections. This file contains data for 2141 UTM cells. The data is: cell coordinate, TAZ number, subregion (not used), 4-letter name, estimated 1970 cell populated and projected cell populations for 1980, 1990 and 2000.
AIR7	P	Scans a CDRPC copy of the Albany-Schenectady-Troy SMSA public use sample tape to find 1970 census data on tenure, heating equipment, year built, number of units/unit and heating fuel used. This data is stored in AIR8 described below.

Name	D - Data P - Program	Contents/Function
AIR8	D	A list of 2517 household records from the Albany-Schenectady-Troy SMSA 1970 census. The data is in the census code. The decoding information is (in column order):

Tenure

0	Owner occupied
1	Coop or condominum
2	Rented for cash
3	No rent
4	Vacant

Heating Equipment

0	Steam or hotwater
1	Central warm air
2	Electric
3	Floor or wall furnace
4	Space heater with flue
5	Flueless space heater
6	Fireplace or stove
7	No heat
8	Not available

Year Built

0	1969-1970
1	1965-1968
2	1960-1964
3	1950-1959
4	1940-1949
5	Before 1939
6	Not available

Units/Unit

0	Single family detached
1	Single family attached
2	Two family
3	Three or four family
4	Five to nine family
5	Ten to nineteen family
6	Twenty to forty-nine family
7	Over fifty family
8	Mobile home
9	Not available

Heating Fuel

0	Piped Gas
1	Bottled Gas
2	Electric
3	Fuel Oil
4	Coal
5	Wood
6	Other
7	None
8	Not available

Name	D - Data P - Program	Contents/Function
AIR9	P	A statistical package for social science cross-tabulation program to obtain cross tabulation of heating fuel type with: number of units/unit, year built, heating equipment and tenure. Also, other cross-tabulations not used in this analysis. The output is paper copy only. No machine readable version of the output is available.
AIR10	D	This data element is a machine readable copy for all AQMA census tracts of the 1970 data in Table H-2 of Report PHC(1)-4 Census Tracts Albany-Schenectady-Troy, N.Y. Standard Metropolitan Statistical Area. Information contained is: Tract ID, all year round housing units, single family, 2-family, 3-4 family, 5 to 49 family, 50+ family, built 69-70, built 65-68, built 60-64, built 60-59, built 40-49, built before 39, steam or hot water, warm air furnace, built-in electric units, floor, wall or pipeless furnance, other means or not heated.
AIR11	D	Data element containing tract level heating for type estimates. See AIR18 for method of generation. Contains: Tract ID, Gas DU's, Electric DU's, Oil DU's, Coal DU's, and Wood DU's.
AIR12	P	Attached census tract identification to the cell level population data in AIR6. Stores output as AIR14.
AIR13	D	A list of all 468 CDRPC TAZ's and the census tract they are in.
AIR14	D	A list of the 2141 cells and their estimated 1970 population and projected 1980, 1990 and 2000 population. Contains: census tract, cell coordinate, TAZ, 4-letter name, estimated 1970 population, projected 1980, 1990 and 2000 populations.
AIR15	P	Sums the 1970 populations in AIR14 by census tract for comparison with census tract figures. This program allows hand-editing data to correct for multiple tract cells. The AIR14 currently in the file is the edited version. Output is AIR 20.
AIR16	P	Sums tract level heating fuel estimates (AIR11) to get AQMA totals for purposes of checking against SMSA level data. No machine readable output.

Name	D - Data P - Program	Contents/Function
AIR17	D	Output is the tract level summation of the disaggregated household information in AIR10. Used only for checking with census tract book data.
AIR18	P	Generates tract level heating fuel estimates from three formulas based on the cross-tabulations in AIR9 and the tract level data in AIR10. The output is the average of the three formulas, and is stored as AIR11.
AIR19	D	A later version of AIR17 - households by tract for checking purposes.
AIR20	D	A summation of the cell level population information in AIR14. Gives population by tract for comparison with census tract book, also as data for input to Program AIR22.
AIR21	D	A modified output of AIR18. Gives tract name, total households, and fraction or tract households heated by gas, electric, oil, coal and wood. Used as input to Program AIR22.
AIR22	P	Computes total households by heating type by cell for 1970. Method is use AIR20 and AIR21 to get avg. household size in a tract. Use this figure on 1970 cell level population from AIR14 to get households/cell. Apply tract level proportions from AIR10 to this number to get cell level households by heating fuel type. Output is AIR23.
AIR23	D	Output of AIR22, estimation of 1970 residential heating fuel splits by cell for 1970. Contains: tract, TAZ, cell ID, 4-letter name, Gas HH, Electric HH, Oil HH, Coal HH, and Wood HH. It should be noted that this cell level information is a mathematical construction, and that the actual numbers for a cell obtained by survey would likely be different.
AIR24	P	A checking program. Sums AIR23 to the AQMA level for comparison with both the SMSA level data, and that generated by AIR16.
AIR25	P	Operates on AIR14 to obtain projected population change from 1970 to 1980, 1970 to 1990, and 1970 to 2000 by cell. The output is AIR26. This data was not used in the submitted AQMA projections.

Name	D - Data P - Program	Contents/Function
AIR26	D	Output of AIR25. Not used in final projection work. Contains tract, TAZ, cell ID, 4-letter name, projected change 1970 to 1980, 1970 to 1990, and 1970 to 2000.
AIR26A	D	A more sophisticated version of AIR26. AIR26A is the output of Program AIR27 and is an estimate of the population for future years that will not be housed in households existing in 1970. This accounts for both the "new" people from AIR26, and those that will move from existing households due to projected declines in household size.
L	P	Program that computes population capacity of existing households in future years due to declining household sizes and then compares this population to that predicted for the cell in the future years, and prints the difference (i.e. the projected population needing new households for the future year) by cell. Output is AIR26A.
AIR27	P	Operates on the data in AIR26A to develop predicted new households by fuel type by cell for 1980, 1990 and 2000. The fuel split is determined by the method discussed under Future Year Fuel Splits in this reprot. Output is AIR28.
AIR28	D	For the 2118 cells with projected new households, gives the tract, TAZ, cell ID, 4-letter name, and new households for 1980, 1990 and 2000 for oil and electric heat.
AIR29	P	Uses data in AIR28 to find predicted new households to year 2000 for each minor civil division. A paper print is obtained. This data is used with information on predicted new land use. From CDRPC Regional Development Plan to obtain new units/acre. This data is used with the chart on page 10 of this report to obtain future year RFR's for each minor civil division.
AIR30	P	Program that uses the census tract data on units/unit from AIR10 and data from volume 13 of the guidelines to calculate RFR's for 1970 for each census tract. Output is AIR31.
AIR31	D	List of tract level RFR's for 1970 computed by AIR30. Contains: tract, 1970 tract households, Gas RFR, Oil RFR, Coal RFR.

Name	D - Data P - Program	Contents/Function
AIR32	P	Uses output of AIR28 and computes mid-decade numbers to meet contract requirements of data for 1975, 1985, and 1995. Output is AIR33.
AIR33	D	New households since 1970 by cell by fuel type for 1975, 1980, 1985, and 1995. Contains: Tract, TAZ, cell ID, 4-letter name and new electric and new oil fueled households since 1970 for 1975, 1980, 1985, and 1995.
AIR33P	P	Combines 1970 cell level data from AIR23, 1970 RFR data from AIR31, predicted new households to future years from AIR33, manually entered future RFR's from AIR29, and fuel data from Volume 13 to produce outputs of fuel consumed for residential heating by fuel type by cell for the contract years. Outputs are AIR75 Fuel, AIR80 Fuel, AIR85 Fuel, and AIR95 Fuel. Note: These computations were done using 6,875 degree days.
AIR34	P	A utility program that produces triple-spaced paper copies of each tract, TAZ, cell ID and name combination. These copies are used for tabulating data from maps.
AIR35	D	A manually produced list of Cell ID's and actual counts of hectares of commercial, institutional and industrial land use from CDRPC's 1" to 1 mile 1973 land use map -- only for multiple cell TAZ's.
AIR36	P	A program to attach the information in AIR35 to a list of all 2152 cells in the AQMA. Output is AIR37.
AIR37	D	A list of TAZ and Cell ID for each cell with counted land use for multiple cell TAZ's.
AIR38	P	A program to sort through CDRPC data file TAZLND to obtain a list of TAZ level measured land uses for all TAZ's in the AQMA. The output is AIR39.
AIR39	D	TAZ level land use in acres for AQMA contains: TAZ, COMM1, COMM2, IN01, IN02, INST. Land Use for each TAZ. For purposes of this work, commercial = COMM1 and COMM2, and industrial = IND1 and IND2.

Name	D - Data P - Program	Contents/Function
AIR40	P	This program was to combine the data in AIR37 at the cell level with that in AIR39 at the TAZ level to get actual commercial, industrial and institutional land use per cell. It was never successfully completed and was not used in the AQMA analysis.
AIR41	D	An incorrect output from AIR40 not used in this analysis.
AIR42	P	Takes CDRPC's 73/74 employment by ID classes by TAZ and apportions it to cells in a TAZ based upon the distribution of the corresponding land use as counted in AIR39. Output is AIR45.
AIR43	P	Takes CDRPC's year 2000 projected population by TAZ and 73/74 population by TAZ and calculates the change in employment by class by TAZ between the base year and 2000. Output is AIR44.
AIR44	D	Projected changes in employment by TAZ between 73/74 and 2000 by class. Contains: TAZ, change in industrial, transportation, finance, government, services, wholesale, retail.
AIR44AQMA	D	A version of AIR44 summed to two classes - industrial and commercial/inst/government. Contains: TAZ and change in industrial, commercial for only area sources.
AIR45	D	Cell level 73/74 employment estimates developed by AIR42. Contains: Cell ID, TAZ, industrial, transportation, finance, government, service, wholesale and retail estimates by cell.
AIR45AREA	D	A version of AIR45 with all employment in the combustion point sources identified in this document subtracted out manually; also certain adjustments were made to account for employment in sources that fell into more than one cell. Contains: Cell ID, TAZ, area source, industrial, transportation, finance, government, service, wholesale and retail employment estimates.
AIR46EMP	D	A simplified version of AIR45AREA containing only the total industrial and commercial area source employment per cell.

Name	D - Data P - Program	Contents/Function
AIR46TOTAL	D	A simplified version of AIR45 containing only total industrial and commercial employment by cell.
AIR46DIFF	P	Subtracts AIR46EMP from AIR46TOTAL to get a list of point source employments by commercial or industrial by cell. Output is AIR46POINT.
AIR46POINT	D	Output of AIR46DIFF. A list of point source adjustments to AIR46TOTAL (or AIR45) to get AIR46-EMP (or AIR45 Area).
AIR50	P	Computes future year area source commercial and industrial employment by cell as discussed on pages 20 and 21 of this report. Output is AIR51.
AIR51	D	Output of AIR50. Estimated cell level future year commercial and industrial area source employment. Contains: Cell ID, TAZ, and industrial and commercial area source employment for 1980, 1985, 1995 and 2000.
AIR75FUEL AIR80FUEL AIR85FUEL AIR95FUEL	D	Outputs of AIR33P. Gives estimated cell level residential fuel use for indicated year by fuel type. Contains: Tract, cell ID, TAZ, 4-letter name, million cubic ft. gas, thousand gallons of oil, tons of coal and tons of wood consumed in the cell for 6,874 degree days.
AIR55	D	A list of the DOT TAZ, CDRPC TAZ, cell ID, 4-letter name and census tract for each cell in the AQMA. Generated manually from MAPS.
AIR56	D	A list of the DOT TAZ and 1975 and 1985 TAZ particulate emissions (in lb/24 hours) from N.Y.S. DOT data for each of the TAZ's in the AQMA.
AIR57	P	Allocates the TAZ level particulate emission estimates to the cell level, converts the lb/24 hour data to tons/year, and estimates sulphur dioxide emissions as 0.383 of the particulate emissions (based on Table 3.11-1 of AP-42). Output is AIR75-85 auto.
AIRAUTOCD	D	Estimated cell level mobile source particulate and sulphur dioxide emissions for 1975, 1980, 1985, 1995 and 2000. Contains: DOT TAZ, CDRPC TAZ, Cell ID, 4-letter name, census tract, 75 particulates, 75 SO_2, 80 particulates, 80SOL, 85 particulates, 85SO_2, 95 particulates, 95SO_2, 2000 particulates and 2000 SO_2 for each cell.

RESIDENTIAL EMISSIONS

As of this date (November 30, 1976) NYSDEC has not been able to provide CDRPC with county level area source inventories. Therefore, CDRPC has computed residential emissions entirely from its own data sources and a modification of the order 3 methodology from Guidelines for Air Quality Maintenance Planning and Analysis Volume 13: Allocating Projected Emissions to Sub-County Areas. The input data consisted of: the actual 1970, and projected 1980, 1990 and 2000 populations by Traffic Analysis Zone; a Traffic Analysis Zone to UTM grid conversion table; the Bureau of the Census publication PHC (1)-4 Census Tracts, Albany-Schenectady-Troy, N.Y.; the Bureau of the Census Public Use Sample for the Albany-Schenectady-Troy, N.Y. SMSA; unpublished State of New York Economic Development Board population and household projections and internal CDRPC data. Each of these data sources is discussed in detail where appropriate.

POPULATION BY UTM CELL - The first step in the residential emission procedure was to obtain population by UTM cell for the years required for AQMA work. This was done using two CDRPC data files and a computer program. Data file AIR2 is an AQMA only copy of CDRPC's file BLDBLK listing the CDRPC coordinate, TAZ number, sub-region, and Minor Civil Division as well as certain macro level estimates of existing and future development for each cell. Data file AIR3 is a copy of TAZPOP, developed as TOMPOP and described in the attached 1975 technical memo #501 Small Area Forecast lists the TAZ number and TAZ level population for the years 1970, 1980, 1990 and 2000. A CDRPC program AIR4 splits the TAZ level populations to the cell level using the fact that TAZ's were designed to be homogeneous. Thus, if there are 10 cells in a TAZ, the population of each cell is simply the TAZ level population divided by 10. The output of this process is AIR6, a data file containing cell coordinate, TAZ number, and cell population for 1970, 1980, 1990 and 2000 for each of the 2152 cells in the AQMA.

There are a few cells that contain more than one TAZ, yet AIR4 can match only one TAZ to a cell. The program therefore makes a list of TAZ's not matched to cells and a hand edit of the data to include the populations of these TAZ's is required. This edit is done directly on the data in AIR6 and the current version of AIR6 includes all necessary hand changes. A list of the TAZ's included in the hand changes is in the appendix of this document.

FUEL SPLIT - The Census of Housing contains data on household heating fuel use by county and certain cities. It would be inappropriate to apply heating fuel splits from the city or county level to all cells in the city or county. Therefore, CDRPC developed a method of estimating heating fuel use by census tract. Program AIR7 creates a data file (named AIR8) of 2517 households and their heating fuel use, number of units/unit, heating equipment and year built from the Public Use Sample Tape. The public use sample is a 1% selection of actual 1970 census returns with all name and address information removed. The reason for creating this file is that number of units/unit, heating equipment type and year built are all reported at the census tract level, while heating fuel use is not.

The program AIR9 is an SPSS cross-tabulation of heating fuel type against each of the other three data types.

The resulting tables were modified to account for areas where pipeline gas is not available, and the only available gas is the more expensive LP gas commonly called propane. The areas with no gas available were determined through discussions with Niagara Mohawk service representative (and CDPPC Commissioner) Thomas McGrath. The resulting tables are:

HEATING FUEL USED VS YEAR BUILT PIPELINE GAS AVAILABLE

HEATING FUEL	Built 1969 and 1970	Built 1965 to 1968	Built 1960 to 1964	Built 1950 to 1959	Built 1940 to 1949	Before 1940
Gas	43.3%	58.6%	57.0%	36.1%	33.5%	54.2%
Electric	21.7%	8.6%	7.0%	0.8%	1.3%	1.0%
Oil	35.0%	32.8%	36.1%	63.1%	63.5%	44.0%
Coal	0%	0%	0%	0%	1.7%	0.8%
Wood	0%	0%	0%	0%	0%	0%

HEATING FUEL VS YEAR BUILT, NO PIPELINE GAS

HEATING FUEL	Built 1969 and 1970	Built 1965 to 1968	Built 1960 to 1964	Built 1950 to 1959	Built 1940 to 1949	Before 1940
LP Gas	40.4%	35.9%	33.3%	33.1%	26.9%	27.2%
Electric	22.8%	13.3%	10.8%	0.9%	1.4%	1.5%
Oil	36.8%	50.8%	55.9%	66.0%	69.8%	66.0%
Coal	0%	0%	0%	0%	1.9%	1.2%
Wood	0%	0%	0%	0%	0%	4.1%

HEATING FUEL VS OCCUPANCY PIPELINE GAS AVAILABLE

HEATING FUEL	1-Family	2-Family	3-4 Family	5-49 Family	50+ Family
Gas	42.9%	68.0%	58.6%	42.1%	32.3%
Electric	1.8%	1.8%	4.7%	7.9%	0%
Oil	54.7%	29.9%	35.3%	50.0%	67.4%
Coal	0.6%	0.4%	1.4%	1.0%	0%
Wood	0%	0%	0%	0%	0%

HEATING FUEL VS OCCUPANCY, NO PIPELINE GAS

HEATING FUEL	1-Family	2-Family	3-4 Family	5-49 Family	50+ Family
LP Gas	28.8%	25.8%	34.1%	36.7%	34.4%
Electric	2.2%	4.1%	7.4%	8.5%	0%
Oil	65.4%	69.2%	56.3%	53.7%	65.6%
Coal	0.7%	0.9%	2.2%	1.1%	0%
Wood	2.9%	0%	0%	0%	0%

HEATING FUEL VS HEATING EQUIPMENT, PIPELINE GAS AVAILABLE

HEATING FUEL	Steam or Hot Water	Warm Air	Electric	Floor, Wall or Pipeless	Other
Gas	42.3%	52.3%	0%	52.2%	82.3%
Electric	0%	1.3%	100.0%	0%	0%
Oil	57.0%	45.9%	0%	43.5%	17.3%
Coal	0.7%	0.5%	0%	4.3%	0.4%
Wood	0%	0%	0%	0%	0%

HEATING FUEL VS HEATING EQUIPMENT, NO PIPELINE GAS

HEATING FUEL	Steam or Hot Water	Warm Air	Electric	Floor, Wall or Pipeless	Other
L.P. Gas	14.4%	23.4%	0%	78.4%	71.5%
Electric	0%	2.0%	100.0%	0%	0%
Oil	84.6%	73.8%	0%	19.6%	16.3%
Coal	1.0%	0.8%	0%	2.0%	0.3%
Wood	0%	0%	0%	0%	11.9%

The following AQMA towns have no pipeline gas available:

Albany County - Towns of Coeymans, New Scotland and Census Tract 146.05 in the Town of Guilderland
Rensselaer County - Towns of Poestenkill, Sand Lake, 75% of Schaghticoke, and 65% of Brunswick
Schenectady County - Town of Princetown, Census Tract 326.0 in the Town of Rotterdam and Census Tract 325.01 in the Town of Glenville.

Thus, we can determine that while 46.2% of the Region's households heat with piped gas, only 1.8% of the mobile homes are heated with piped gas. From the output of AIR9, equations giving the number of dwelling units using a given heating fuel type can be developed for each of the three data items reported in the census tract book. Each of these three equations has some flaw that makes it undesireable to use it alone for generating tract level heating fuel uses. For example, each equation has one data choice that con-

tains over 50% of the total sample. (These categories are single-family detached, 54.1%; built before 1939, 56.4%; and steam or hot water heating equipment, 50.3%).

It was felt by the CDRPC staff that while no single equation was clearly superior to the other two, all had some strengths, and the heating fuel types for a tract could reasonably be estimated by taking the average of the estimates given by each of the three equations. The mechanics involved were to build data file AIR10 containing tract number, total households, units in structure, year built and heating equipment from the tract book. Then the program AIR18 was written to predict households by fuel type for each tract by each method and to take the average of the three equations. The total output of AIR18 was printed so that it could be manually skimmed for any gross inconsistencies between formulas and the averages were written as data element AIR11. This process gave households by fuel type by census tract. For AQMA work this information is required at the UTM cell level.

No TAZ boundary crosses a census tract boundary. Therefore, each census tract can be viewed as consisting of many TAZ's. Element AIR13 is list of each TAZ with the number of the tract it is in. Program AIR12 attaches this information to the adjusted cell level populations from AIR6 and the aggregate information is stored in AIR14. As with AIR6, problems of lost tracts occurred in densely developed areas where more than one tract was located in a single UTM cell. These problems were addressed by manually editing AIR11 to combine tract data so that each combined tract represented a minimum of one entire UTM cell. Program AIR15 was used to check element AIR14 by adding up the TAZ population data to the tract level for comparison with the census tract book. Program AIR16 checks element AIR11 by computing total households by heating fuel type for the AQMA for comparison with SMSA level data. The AQMA is smaller than the SMSA so the totals from AIR16 should be less than the numbers in the tract book. The output of AIR11 accounts for 92% of the gas, 91% of the electric, 89% of the oil, 98% of the coal and 61% of the wood heating fuel in the SMSA.

Program AIR22 takes the information from the adjusted AIR11 and AIR14 and gives each cell a share of the tract households by fuel type proportional to the ratio of the cells population to the total tract population. This method assumes a constant fuel split in a tract, and as no better information is available the assumption is necessary. The output of this program is AIR23 which gives the number of dwelling units using each fuel type for each UTM cell for 1970.

The results of this process AIR23 contains data on over 2000 cells. This information is so detailed, it is hard to check it for reasonableness. Therefore, a program (AIR23ADD) was written to sum this information to the county level. The results are presented below:

HOUSEHOLDS BY HEATING FUEL TYPE BY COUNTY PORTIONS 1970

CAPITAL DISTRICT AIR QUALITY MAINTENANCE AREA

County	Total	Gas	Electric	Oil	Coal	Wood
Albany	97,192	47,609	2,350	46,562	613	58
Rensselaer	42,841	20,294	1,033	21,225	211	78
Saratoga	11,382	5,702	413	5,226	41	0
Schenectady	54,197	25,930	1,234	26,646	361	26
AQMA	205,612	99,535	5,030	99,659	1,226	162

RELATIVE FUEL REQUIREMENTS - Volume 13 of the Guidelines goes into great detail over the fact that multiple unit buildings use less fuel per unit than do detached single family dwellings. This effect is very important to the Capital District AQMA as most dwelling units near the "hot spots" are primarily multiple family units. The units in structure data from the census tract book was used to arrive at RFR's for gas and oil for each tract. The only problem in this process is that volume 13 breaks down the census tract book's 5 to 49 class into three classes (i.e. 5 to 9, 10 to 19, 20 to 49). Data from the public use sample tape was used to determine a composite RFR for the 5 to 49 unit group for each fuel type. The results are coal .47, oil .721, gas .672. Program AIR30 uses information in data file AIR11 and volume 13 of the Guidelines to compute an RFR for each tract for 1970.

OTHER YEARS - The Process described above gives the data necessary to calculate residential fuel use by UTM cell for 1970. However, the maintenance analysis contract requires this information for the years 1975, 1980, 1985, and 1995. As there is no published measured data for 1975 which is comparable to the 1970 Census of Housing, and since the years 1980, 1985 and 1995 are in the future, a method of projecting changes since 1970 was developed.

The first step is to subtract the population due to group quarters from the cell level population contained in AIR14 for 1970, 1980, 1990 and 2000. It would have been desireable to do this for the 1970 work, however, as the actual count of households per tract (instead of a number computed from household size and population) was used for that work, the inclusion of group quarters population in a tract made no difference.

The next step was to obtain estimates of average household sizes for the future. The New York State Economic Development Board has published projections of both population and numbers of households by county. Thus for a given county the average household size in a future year is the projected population divided by the projected number of households. The results of this process are:

AVERAGE HOUSEHOLD SIZE BY COUNTY

Year	Albany	Rensselaer	Saratoga	Schenectady
1970	3.053	3.255	3.389	3.038
1975	2.900	3.078	3.295	2.891
1980	2.738	2.963	3.130	2.772
1985	2.619	2.828	2.984	2.661
1990	2.513	2.754	2.892	2.607
1995	2.467	2.730	2.788	2.597
2000	2.408	2.651	2.755	2.531

Source: NYS EDB county level projections

The third step was to determine the number of inhabitants projected to live in a cell that would not be housed in the number of housing units currently in the cell. For example:

> A cell in Albany County has 305 people in 1970, this is 100 housing units. With declining household size, these same 100 housing units would be expected to house 274 people in 1980, so 31 people would need new housing units by 1980 if there was no change in the cells population. Any changes to the cells total population between 1970 and 1980 would be added to or subtracted from this 31 people to get the total number of people in the cell requiring new housing.

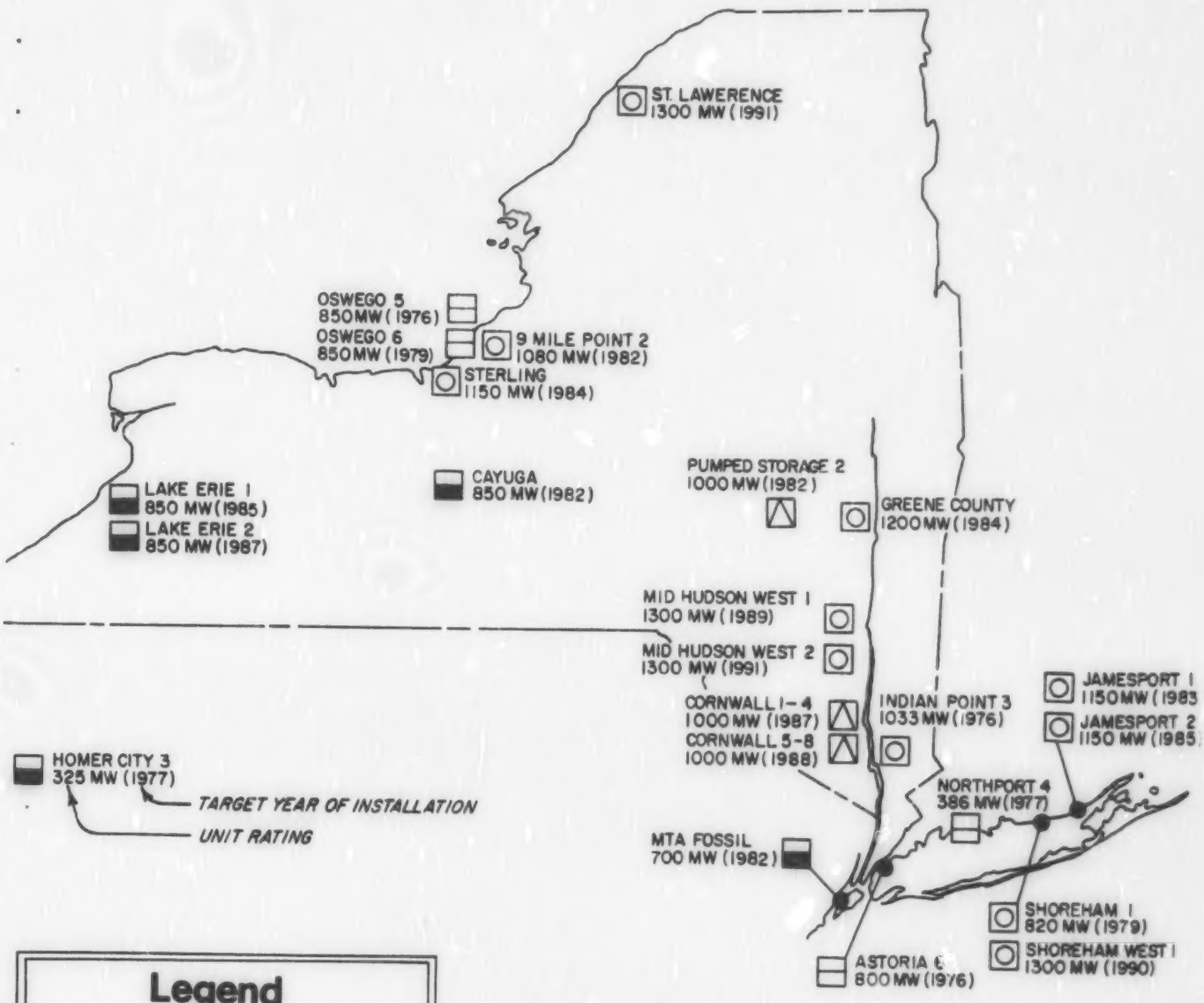
This work was done by a computer program called L (because of a key-punch error) and the results -- a list of the number of people needing new housing in 1980, 1990 and 2000 by cell is data file AIR26A. This information plus average household size allows us to project new dwelling units per cell; but for emissions, a fuel split is necessary.

FUTURE YEAR FUEL SPLITS - Given present technology, the number of new homes with coal or wood heat is significant. Additionally, no new natural gas hook-ups are presently allowed, and there is no evidence to suggest that this ban will end. Therefore, almost all new dwellings can be assumed to be heated with oil or electricity.

The tables of heating fuel type versus year built obtained from the cross tabulations of AIR9 show that the percentage of new residential dwellings using electric heat has increased dramatically from less than 1% of units built before 1960 to 22% of units built in 1969 and 1970. If this trend continues, all new housing units will use electric heat before the year 2000.

The only available projections of electric vs non-electric (assumed to be oil) heating are those used by the electric utilities in the load forecasting section of their annual 149-b long-range plans submitted to the New York State Public Service Commission. Their contention is that the easily useable fuels (i.e. oil and gas) are becoming scarce and expensive, and that electric utilities are much more able to use dirty fuels such as coal, dang-

EXHIBIT 2 Location of Major Generating Additions



Legend

- Pumped Storage Hydro
- Oil
- Coal
- Nuclear

erous fuels such as nuclear and hard to tap sources of energy such as hydro and geothermal. This ability and the scarcity of clean fuels will overcome the thermodynamic inefficiencies of present electric generation technology and give electric heat a very large share of the new housing market, and a reasonable share of the heating plant replacement market. It should be noted that the 149-b Plans are internally consistent, and that sufficient new generating capacity is contained in the Plans to meet the projected loads from all new sources including new electric heating customers. Figure 1 of this report, which is Exhibit 2 of the 1976 149-b Plan, shows the location of major generating additions planned through 1990. None are in the Capital District AQMA.

To estimate the future electric vs non-electric fuel splits, the load forecast projections of the two electric utilities serving the Capital District AQMA were examined in detail. These two utilities are: the Niagara Mohawk Power Corporation which serves most of the AQMA, and the New York State Electric and Gas Corporation.

NIAGARA MOHAWK - the forecasts of future electric heating for the N-M Service Area is contained in Table 15 "APPLIANCE CONTRIBUTION TO KWH GROWTH" on pages 216 and 217 of Volume I of the 1976 149-b Plan.

Year	Total Electric Customers	% of Customers With Electric Heat	# of Customers With Electric Heat	# of Customers Since 1970	# of New Electric Heat Since 1970	# New Electric Heat as % of New Customers
1964	944,143	0.3	2,832	-	-	-
1966	972,864	0.5	4,864	-	-	-
1970	1,057,280	1.2	12,687	-	-	-
1974	1,117,457	2.0	22,349	9,662	60,177	16.06
1980	1,224,900	7.3	89,418	76,731	167,620	45.78
1990	1,369,700	15.0	205,455	192,768	312,420	61.70
1995	1,421,500	17.4	247,341	234,654	364,220	64.43

New York State Electric and Gas - The forecasts of future electric heating for the NYSE&G Service Area is contained in Table VI. "Annual Saturation of Electrically Heated Dwelling Units" on page 179 of Volume 1 of the 1976 149-b Plan.

Year						
1965	456,879	0.43	1,959			
1970	501,790	2.14	10,759			
1975	557,000	6.20	34,531	55,210	23,772	43.06
1980	617,000	11.76	72,534	115,210	61,775	53.62
1985	671,000	19.80	132,834	169,210	122,075	72.14
1990	730,000	29.05	212,034	228,210	201,275	88.10
1995	780,000	37.44	292,034	278,210	281,275	101.10

Examination of these two tables gives the following table:

EXPECTED % ELECTRIC HEAT IN "NEW" RESIDENTIAL CONSTRUCTION
(Since 1970)

Year	NYSE&G	N - M	Actual*
1970	24.28	9.27 (years 66-70)	22%
1975	43.06	16.06 (1974)	30%
1980	53.62	45.78	
1985	72.14	Missing Data	
1990	88.20	61.70	
1995	101.10	64.43	

* 1970 Actual from Capital District Public Use Sample Tape, 1975, from Telephone Survey by Dr. George Kerr, Project Officer, USEPA.

It can be seen that, if the actual numbers are correct, Niagara Mohawk is consistently underestimating actual new electric heat as a % of new units, while NYSE&G is consistently overestimating such heating. The average of the two numbers is, however, very close to the actual.

CDRPC's original estimate of these percentages used in the AQMA analysis is essentially the average of the NYSE&G and the N-M estimates except for 1990 which is not a year for which data is required under this contract. For the year 2000, CDRPC held to its 1990 and 1995 estimate of 80%. This can be expected to be below the average of the NYSE&G and N-M year 2000 estimates if they follow the same trends as in the past. The table below verifies the closeness of these CDRPC estimates to the average of the NYSE&G and N-M estimates.

CDRPC ELECTRIC HEAT ESTIMATES VS AVERAGE NYSE&G, N-M ESTIMATE

Year	NYSE&G, N-M Average	CDRPC
1975	29.56	30
1980	49.70	49
1985	62.94	65
1990	74.95	80
1995	82.77	80

New Dwelling Units/Cell - The program AIR27 takes the additional population to be housed in a cell for a future year, divides it by the average household size for that county for the year and gets new housing units per cell for that year. It then multiplies these cells by the fractions electric and non-electric to get new dwelling per cell by fuel type for 1980, 1990 and 2000. This data is in file AIR28.

Future RFR's - The CDRPC preliminary Regional Development Plan gives the expected additional acres of residential development for each Minor Civil Division through the year 2000. Program AIR29 finds the total additional dwelling units per Minor Civil Division through the year 2000. The RFR for

new development in a Minor Civil Division is determined by dividing new housing units in an MCD by new residential land and comparing the resulting density to the following RFR list developed by CDRPC from the RFR's for dwelling type in Volume 13 of the Guidelines:

New Units/Acre	RFR	Assumed Housing Type
Up to 7	1.0	Single Family
7 to 20	0.9	2 to 4 Family
20 to 49	[0.9-(.011*(units/acre-20))]	5 to 49 Family
Over 50	.51	Over 50 Family

Thus each city and town has a single RFR for future development. These numbers were calculated manually from the output of AIR29.

Years 1975, 1985, 1995 - CDRPC has not made detailed projections to the five year level. Whenever information is needed for these mid-decade years, it is found by interpolation from the projection years surrounding it. In this case, it was assumed that at the cell level the number of new dwelling units for a mid-decade year could be considered the linear average of the two end points of its decade. Thus new growth to 1975 is 50% of new growth to 1980. This assumption seems superior to making many assumptions concerning varying rates of population growth, household formation, etc. Program AIR32 uses this assumption along with the fuel type assumptions listed earlier to yield new oil and electrically heated homes by cell for 1975, 1980, 1985, 1990 and 1995. This data is stored as AIR33.

As with AIR23, the data in AIR33 is not easily understood at the cell level. Therefore, the following table of AIR33 summed to the county level was generated by a program called AIR33ADD.

NEW HOUSEHOLDS SINCE 1970 BY FUEL TYPE BY COUNTY
CAPITAL DISTRICT AIR QUALITY MAINTENANCE AREA

	1975		1980		1985		1995	
COUNTY	Oil	Electric	Oil	Electric	Oil	Electric	Oil	Electric
Albany	4649	1871	6673	6431	7396	13658	7048	28186
Rensselaer	2524	1064	3794	3453	3842	7285	3404	13619
Saratoga	1547	637	2247	2152	2298	4271	2072	8374
Schenectady	1907	782	2743	2624	3401	6346	3382	13544
AQMA TOTALS	10627	4354	15457	14660	16937	31560	15906	63723

FUEL USE - Residential fuel use can be generated for each cell using fuel use factors from Volume 13 of the Guidelines and in the case of wood APTD-1135. For a single family dwelling, these factors are:

Coal	2.38 lb./DD
Oil	.157 gal/DD
Gas	26.6 $ft.^3$/DD
Wood	3.4 lb./DD
DD =	Degree Days

For the Capital District AQMA, DD = 7,462, so for single-family dwellings, the average annual fuel requirements are:

Coal	8.88 Tons/year
Oil	1.17×10^3 Gal/year
Gas	0.199×10^6 Ft^3/year
Wood	12.7 Tons/Year

Thus the fuel use for a cell for 1970 for oil = (1.08×10^3 gal) * (number of oil heat dwellings from AIR23) * (RFR for tract from AIR31). And, additional oil fuel use in future years is: (1.08×10^3 gal) * (number of additional oil heat dwellings from AIR33) * (RFR for MCD from output of AIR29). In this manner the fuel use per grid cell by type of fuel for each target year can be estimated. These calculations are done by program AIR33P which has been run for the contract years 1975, 1980, 1985, and 1995. The outputs are stored as AIR75FUEL, AIR80FUEL, AIR85FUEL, and AIR95FUEL. Each of these data elements contains the census tract, CDRPC coordinate, TAZ, MCD, MCF of gas, 1000 gallons of oil, tons of coal, and tons of wood consumed for each of the 2152 cells in the AQMA for the indicated year.

These fuel elements are difficult to understand at the cell level. Therefore, a program called FUELADD was written. This program sums the fuel elements by county, and calculates the emissions using AD-42 emission factors.

1975 RESIDENTIAL FUEL USE BY COUNTY
CAPITAL DISTRICT AIR QUALITY MAINTENANCE AREA

COUNTY	MCF GAS	M/ OIL	TONS COAL	TONS WOOD
Albany	8,525	55,157	4,789	737
Rensselaer	3,708	25,986	1,681	991
Saratoga	1,077	7,440	335	0
Schenectady	4,901	31,156	2,870	330
AQMA TOTAL	18,211	119,741	9,675	2,058

1975 RESIDENTIAL EMISSIONS BY COUNTY (TONS)
CAPITAL DISTRICT AIR QUALITY MAINTENANCE AREA

	Gas		Oil		Coal		Wood		Total	
COUNTY	PART.	SO_2	PART.	SO_2	PART.	SO_2	PART.	SO_2	PART.	SO_2
Albany	43	3	69	1175	24	144	4	1	140	1323
Rensselaer	19	1	32	554	8	50	5	1	64	606
Saratoga	5	0	9	158	2	10	0	0	16	168
Schenectady	25	1	39	664	14	86	2	0	80	751
AQMA TOTAL	92	5	149	2551	48	290	11	2	300	2848

1980 RESIDENTIAL FUEL USE BY COUNTY
CAPITAL DISTRICT AIR QUALITY MAINTENANCE AREA

COUNTY	M/CF GAS	M/GAL OIL	TONS COAL	TONS WOOD
Albany	8,525	57,333	4,789	737
Rensselaer	3,708	27,324	1,681	991
Saratoga	1,077	8,156	335	0
Schenectady	4,901	32,052	2,870	300
AQMA TOTAL	18,211	124,865	9,675	2,058

1980 RESIDENTIAL EMISSIONS BY COUNTY
CAPITAL DISTRICT AIR QUALITY MAINTENANCE AREA

	GAS		OIL		COAL		WOOD		TOTAL	
COUNTY	Part	SO_2	Part	SO_2	Part	SO_2	Part	SO_2	Part	SO_2
Albany	43	3	72	1221	24	144	4	1	143	1369
Rensselaer	19	1	34	582	8	50	5	1	66	634
Saratoga	5	0	10	174	2	10	0	0	17	184
Schenectady	25	1	40	683	14	86	2	0	81	770
AQMA TOTAL	92	-	156	2660	48	290	11	2	307	2957

1985 RESIDENTIAL FUEL USE BY COUNTY
CAPITAL DISTRICT AIR QUALITY MAINTENANCE AREA

COUNTY	M/CF GAS	M/GAL OIL	TONS COAL	TONS WOOD
Albany	8,525	58,119	4,789	737
Rensselaer	3,708	27,390	1,681	991
Saratoga	1,077	8,209	335	0
Schenectady	4,901	32,767	2,870	300
AQMA TOTAL	18,211	126,485	9,675	2,058

1985 RESIDENTIAL EMISSIONS BY COUNTY
CAPITAL DISTRICT AIR QUALITY MAINTENANCE AREA

	GAS		OIL		COAL		WOOD		TOTAL	
COUNTY	Part	SO_2	Part	SO_2	Part	SO_2	Part	SO_2	Part	SO_2
Albany	43	3	73	1238	24	144	4	1	144	1386
Rensselaer	19	1	34	583	8	50	5	1	66	635
Saratoga	5	0	10	175	2	10	0	0	17	185
Schenectady	25	1	41	689	14	86	2	0	82	785
AQMA TOTAL	92	5	158	2694	48	290	11	2	309	2991

1995 RESIDENTIAL FUEL USE BY COUNTY
CAPITAL DISTRICT AIR QUALITY MAINTENANCE AREA

COUNTY	M/SF GAS	M/GAL OIL	TONS COAL	TONS WOOD
Albany	8,525	57,752	4,789	737
Rensselaer	3,708	26,941	1,681	991
Saratoga	1,077	7,980	335	0
Schenectady	4,901	32,749	2,870	330
AQMA TOTAL	18,211	125,422	9,675	2,058

1995 RESIDENTIAL EMISSIONS BY COUNTY
CAPITAL DISTRICT AIR QUALITY MAINTENANCE AREA

COUNTY	GAS		OIL		COAL		WOOD		TOTAL	
	Part.	SO_2	Part.	SO_2	Part.	SO_2	Part.	SO_2	Part.	SO_2
Albany	43	3	72	1230	24	144	4	1	143	1378
Rensselaer	19	1	34	574	8	50	5	1	66	626
Saratoga	5	0	10	170	2	10	0	0	17	180
Schenectady	25	1	41	698	14	86	2	0	82	785
AQMA TOTAL	92	5	157	2672	48	290	11	2	308	2969

The following emission factors current through Supplement 6 of AP-42 were used:

FUEL		SO_2	"S" IS
Coal (Anthricite)	10Lb/Ton Coal	36S Lb/Ton Coal	1.7
Oil (#2)	2.5Lb/MGal	142S lb/MGal	0.3
Gas	10Lb/1000 MCF	0.6Lb/1000 MCF	-
Wood	10 LB/1000 MCF	1.5LB/Ton Wood	-

These data files fulfill the workplan requirements for residential emissions as detailed in the June 18, 1975 work plan.

COMMERCIAL - INDUSTRIAL - INSTITUTIONAL ALLOCATIONS

There is no reliable way to generate fuel use estimates for these classes from the bottom-up using published information as there is for the residential class. Therefore, SMSA level area emissions are to be allocated to grid squares using the appropriate type of employment. Obviously, the employment must be adjusted for any point sources so that cells containing point sources are not also allocated area emissions for the employment covered by the point source.

EMPLOYMENT DATA - CDRPC has employment data by category by TAZ as described in the attached 1975 Memo #501 Small Area Forecast. The first step was to organize the data in the existing file for AQMA use. A recent NYS DEC decision is to compute all non-residential area sources as industrial or commercial - institutional - government (hereafter called commercial for convenience). Industrial employment corresponds to CDRPC employment Group 3 or manufacturing (SIC's 19-39), while commercial employment corresponds to CDRPC groups 4, 5, 6, 7, 8 and 9 (SIC's 40-50, 52-67, 70-86, 89-93 and 99) it should also include a part of CDRPC group 1; however, due to the small size of this group, its exclusion should not affect the allocations.

LAND USE COUNT - Although TAZ's are chosen to be homogeneous; due to the very limited geographical extent of these uses, (Commercial 0.7%, Industrial 0.6%, and institutional 1.1% of regional land) it would be inaccurate to allocate a TAZ's employment evenly among the cells in the TAZ. Therefore, a manual count of industrial, commercial and institutional land use per cell for the AQMA from a 1" to 1 mile land use map was undertaken. The land was counted in hectares so the count for a cell was also the percent of the cell with that land use type. The results of this count are coded in AIR37 which gives the TAZ, cell ID, and percent commercial, institutional and industrial for each of the 2152 cells in the AQMA.

EMPLOYMENT PER CELL - Computer program AIR42 allocated existing employment by TAZ to cells based upon the land use counts in hectares for cells within the TAZ. Land use measurements are not perfect (many parcels of land are mixed use, but coded only as one use); therefore, in some TAZs there were no cells with land uses corresponding to the type of employment in the TAZ. In this case, the program allocated the employment evenly between the cells in the TAZ. The output of this process is AIR45, a list of employment by appropriate group for each of the 2152 cells in the AQMA.

POINT SOURCE ADJUSTMENT - Data file AIR45 gives total employment by group by cell. As mentioned in the introduction to this section, employment associated with point sources must be subtracted out before this information is useful for area emission allocation. The employment associated with the greater than 10-ton year combustion point sources in the following table was manually subtracted out of file AIR45 and the result stored as AIR45AREA.

COMBUSTION POINT SOURCES SUBTRACTED FROM AIR45

LOC	FACILITY NO.	NAME	EMPLOYMENT TYPE	ALSO OVER 25 TONS/YEAR
010100	0307	Agway Inc. Port of Albany	I	yes
010100	0014	Albany Felt Company	I	yes
010100	0452	Albany Garage	C	yes
010100	0427	Alumni Quadrangle	C	
010100	0033	Barvoets Associates Corp	I	
010100	0429	Bd. of Educ.Sch.Dist.Alb.	C	
010100	0428	Campus Power Plant OGS	C	yes
010100	0506	Cirilio Bros.Petrol-Alb.	I	yes
010100	0362	College of St. Rose	C	yes
010100	0490	DeWitt Clinton	C	yes
010100	0518	Downtown Campus	C	yes
010100	0451	Grand City Container	C	
010100	0477	Home Savings Bank Bldg.	C	
010100	0489	Hotel Wellington	C	yes
010100	0306	Killip Services Co. Inc.	C	
010100	0512	LaSalle School	C	
010100	0450	Mack Trucks	I	
010100	0364	Memorial Hospital	C	yes
010100	0422	N.Y.S. Dept.of Mental Hyg.	C	yes
010100	0416	NYS Dept. of Health	C	yes
010100	0449	Pacific Molasses	I	
010100	0516	Sheridan Steam Pl	C	yes
010100	0368	St. Peters Hosp	C	yes
010100	0471	Star Textile	I	yes
010100	0261	Tobin Packing	I	yes
010100	0332	US VA Administration	C	yes
010300	0466	Abram Lansing School	C	
010300	0345	Cohoes Memorial Hospital	C	yes
010300	0185	Mohawk Paper Mills, Inc.	I	yes
011800	0305	D & H Loco Repair Shop	C	yes
011800	0463	St. Patrick Sch	C	
011800	0298	Watervliet Arsenal	C	yes
011800	0401	Watervliet H.S.	C	yes
012200	0333	Bethlehem Central School Dist	C	yes
012200	0437	Bethlehem Central School	C	yes
012200	0457	Elsmere Elem	C	
012200	0514	Feura Bush Filtration Plant	C	yes
012200	0458	Hamagrael	C	

012200	0129	Noryl Products Sec	I	yes
012200	0455	Slingerlands Elem	C	
012401	0040	Atlantic Cement Co. Inc.	I	yes
012401	0122	Coeymans Rlty Co., Inc.	I	yes
012401	0439	Ravena Coeymans Selkirk Sch	C	
012600	0339	Albany County Nursing Home	C	
012600	0080	Coated Abrasive & Tape Div	I	
012600	0425	Homart Development Co.	C	yes
012600	0369	N. Colonie Central Sch	C	
012600	0393	N. Colonie Central Sch	C	
012600	0395	N. Colonie Central Sch	C	
012600	0388	N. Colonie Central Sch	C	
012600	0391	N. Colonie Central Sch	C	
012600	0353	S. Colonie Sch Dist #1	C	
012600	0432	S. Colonie Sch Dist	C	
012600	0433	S. Colonie Sch Dist	C	
012600	0434	S. Colonie Sch Dist	C	yes
012600	0461	St. Agnes School	C	
012601	0436	S. Colonie Sch Dist #1	C	
012603	0467	Menands School	C	
012603	0500	Montgomery Ward	C	yes
012603	0285	Williams Press	I	yes
012800	0126	Bendix Friction Mat Div	1	yes
012801	0117	Ford Motor Co.	1	yes
012801	0151	Manning Paper Co.	I	yes
013000	0509	Guilderland Central Sch	C	
013089	0335	Griffen Lab	C	yes
013400	0460	Voorheesville Elem Sch	C	
013400	0459	Voorheesville High Sch	C	yes
381400	0042	GAF Corp	I	yes
381400	0067	Huyck Felt	I	yes
381400	0190	Van Renss Sch	C	
381400	0153	William Barnet & Son	I	yes
381700	0167	Bio-Environ Eng Div (RPI)	C	yes
381700	0025	Chevron Asphalt	C	yes
381700	0192	Cluett Peabody & Co., Inc.	I	yes
381700	0201	Enlarged City Sch Dist-Troy	C	
381700	0202	Enlarged City Sch Dist-Troy	C	
381700	0210	Enlarged City Sch Dist-Troy	C	yes
381700	0169	Samaritan Hospital	C	yes
381700	0186	St. Marys Hospital	C	yes
382400	0122	Sterling Winthrop Res Ins Di	I	yes
383200	0226	Van Rensselaer Manor	C	yes
384400	0235	Brown Co.	I	yes
421500	0172	American Coat Apron Laundry	C	yes
421500	0161	Associated Linen Services Inc	C	
421500	0162	Coyne Ind Laundry	C	yes
421500	0188	Judicial Building	C	
421500	0190	Linton High School	C	yes
421500	0197	Niskayuna School Dist	C	
421500	0089	Schenectady Chemicals	I	yes
421500	0213	Schenectady Chemicals	I	yes

421500	0195	Service Linen Supply Inc	C	yes
421500	0193	St. Clares Hosp	C	yes
421500	0177	Trustees Union College	C	yes
421500	0036	General Electric Co	I	yes
422201	0019	GSA Depct	C	
422201	0187	Sr High School	C	
422289	0135	Glenridge Hosp	C	
422400	0020	Consolidated Diesel Elec Co.	I	
422400	0168	Dept of Mental Hygiene	C	
422400	0155	General Elec Res & Devel	C	yes
422800	0107	Campbell Plastics Inc	I	
422800	0179	Draper School	C	
422800	0173	Mohonasen Central Sch	C	yes
422800	0174	Mohonasen Central Sch	C	
422800	0175	Mohonasen Central School	C	
422800	0204	Schalmont HS	C	
422800	0090	Schenectady Chemicals Inc	I	yes
412400	0132	Karigon-Orenda Elem	C	
412400	0130	Middle School A	C	
412400	0126	Schenendehowa Cent Sch	C	yes
412400	0131	Skano-Tesago Elem Sch	C	
415489	0124	Silicone Prod Dept	I	yes

ALLOCATING BASE YEAR EMISSIONS - Once the employment associated with all point sources is subtracted out, the SMSA contains a total of 29,053 area source industrial employees. Thus the share of industrial area emissions for a cell in the AQMA = cell ind emp/SMSA ind emp. Similarly, for commercial, there are 150,865 area commercial employees in the SMSA and thus the share of area commercial emissions for a cell in the AQMA = cell com emp/SMSA com emp. In order to facilitate the necessary calculations, the data file AIR46EMP was generated from AIR45AREA. AIR46EMP is simply a list of the total industrial and commercial area employment per cell for 1974. The problems associated with multiple TAZ cells in the residential work also existed in this commercial industrial work, and AIR46EMP was manually edited to include these other employees.

PROJECTION OF FUTURE EMISSIONS - Future year emissions were calculated from base year emissions and growth (or decline) factors. In lieu of sophisticated technological analysis, the assumption was made that emissions per employee remains constant over time. The result of this assumption is that for each point and area source, future emissions can be estimated from base year emissions if future employment is known. In order to make maximum use of existing data, the apportionment of future emissions was done in three steps.

INDUSTRIAL POINT SOURCE: The SIC number is known for each point source. CDRPC's Technical Report 500-4 Population, Income and Employment Forecasts for the Capital District Region gives regionwide employment by sector for future years (Table 16 on page 41). These sectors were converted to SIC groups and the growth or decline rate for each SIC group to future years was computed. Next, it was assumed that each individual point source in-

dustry had the same growth or decline rate as that industry has on a regional basis. The result is a series of growth factors listed below. Note that as 1995 employment was not listed on Table 16, it is found by linear interpolation from projections of 1990 and 2000 employment.

GROWTH RATE FOR EACH INDUSTRIAL POINT SOURCE

LOC	FAC	NAME	1980	1985	1995	2000
010100	0307	Agway Inc Port of Albany	.7931	.6345	.4310	.3448
010100	0014	Albany Felt Company	.8226	.7177	.5847	.5323
010100	0033	Barvoets Associates Corp	1.0204	1.0612	1.1531	1.2041
010100	0506	Cirilio Bros. Petrol	1.0566	1.1321	1.2677	1.3325
010100	0450	Mack Trucks	.9333	.8666	.8666	.8666
010100	0449	Pacific Molasses	.7931	.6345	.4310	.3448
010100	0471	Star Textile	.8266	.7177	.5847	.5323
010100	0261	Tobin Packing	.7931	.6345	.4310	.3448
010300	0185	Mohawk Paper Mills	1.0238	1.0476	1.0833	1.0952
012200	0129	Noryl Products Sec	1.0566	1.1321	1.2677	1.3325
012401	0122	Coeymans Rlty Co.	.7931	.6345	.4310	.3488
012401	0040	Atlantic Cement	1.0417	1.0694	1.1111	1.1250
012600	0080	Coated Abrasive & Tape Di	1.0417	1.0694	1.1111	1.1250
012603	0467	Williams Press	1.0204	1.0612	1.1531	1.2041
012800	0126	Bendix Friction Mat.Div	1.0417	1.0694	1.1111	1.1250
012801	0117	Ford Motor Company	.9333	.8666	.8666	.8666
012801	0151	Manning Paper	1.0238	1.0476	1.0833	1.0952
381400	0042	GAF Corp	1.0566	1.1321	1.2677	1.3325
381400	0153	William Barnet & Co	.8226	.7177	.5847	.5323
381400	0067	Huyck Felt	.8226	.7177	.5847	.5323
381700	0192	Cluett Peabody & Co	1.0238	1.0476	1.0833	1.0952
382400	0122	Sterling Winthrop Res.Ins	1.0566	1.1321	1.2677	1.3325
384400	0235	Brown Company	1.0238	1.0476	1.0833	1.0952
415489	0124	Silicone Prod Dept.	1.0566	1.1321	1.2677	1.3325
421550	0089	Schenectady Chemicals	1.0566	1.1321	1.2677	1.3325
421500	0213	Schenectady Chemicals	1.0566	1.1321	1.2677	1.3325
421500	0036	General Electric	1.0000	1.0104	1.0312	1.0417
422400	0020	Consolidated Diesel	.9333	.8666	.8666	.8666
422800	0107	Campbell Plastics	.9400	.9000	.7700	.7000
422800	0090	Schenectady Chemicals	1.0566	1.1321	1.2677	1.3325

Applying the factors shown above to the base year employment for each company results in a projection of the total AQMA point source employment growing from 28,062 in 1975 to 28,997 in the year 2000. This is counter to the trend for all industries and indicates that these industries will contribute a greater air pollution load than would be suspected from an examination of total industrial employment. In order to estimate area source employment, it is also necessary to consider industrial point sources inside of the SMSA but outside of the AQMA. An identical process was followed and the following summarizes the results.

INDUSTRIAL POINT SOURCE EMPLOYMENT BY LOCATION BY YEAR
ALBANY-SCHENECTADY-TROY SMSA

	1975	1980	1985	1995	2000
Inside AQMA	28,062	27,869	28,011	28,687	28,997
Outside AQMA	2,108	2,071	2,039	2,030	2,006
SMSA TOTAL	30,170	29,940	30,050	30,717	31,003

INDUSTRIAL AREA SOURCES: CDRPC data file EMPLOYMENT70 was subtracted from file EMPZONE200-R to give the projected change in employment by TAZ for each employment group between 1970 and 2000. This data was compressed into the commercial-industrial breakdown and limited to AQMA TAZs. Additionally, the corrections necessary to adjust for multiple TAZ cells were made. Next, the changes in point source employment developed above were added to or subtracted from the appropriate TAZs. The output of this largely manual process is a data element AIR44AQMA which contains the projected changes in area source industrial and commercial employment for each TAZ in the AQMA through the year 2000. Total industrial employment is given in Table 15 of CDRPC report 500-4 referenced above. Total point source employment is given above, thus the total area source industrial employment for each contract year can be computed.

CHANGES IN AREA SOURCE INDUSTRIAL EMPLOYMENT

	1975	1980	1985	1995	2000
Total Ind Emp	57,115	55,710	54,975	54,953	55,020
Point Source	28,062	27,869	28,011	28,687	28,997
Area Source	29,053	27,841	26,964	26,266	26,023
Area Source Change Since 1975	0	-1,212	-2,089	-2,787	-3,030
% of Total Change	0	40.00	68.94	91.98	100.00

If each cell in a TAZ is assumed to change the same percentage and direction as each other cell in the TAZ (a reasonable assumption due to the homogenity of a TAZ), then the cell level employment in a future year can be computed as follows:

$$\text{Additional Future Year Cell Empl.} = \frac{\text{(Base Year Cell Emp)}}{\text{(Base Year TAZ Emp)}} * \frac{\text{(TAZ Employment)}}{\text{(Chg.to Yr.2000)}} * \text{(\% 2000 chg. to future year)}$$

and

$$\text{Future Year Cell Emp.} = \text{Base year cell emp + additional future year cell emp.}$$

Program AIR50 does this calucation for each of the 2152 cells in the AQMA for each projection year. The output is stored as AIR51.

COMMERCIAL POINT SOURCE EMPLOYMENT: The commercial class of employment is projected to grow by almost 100% by the year 2000. Yet, individual point sources (schools, hospitals, shopping centers, etc.) should experience no additional heating loads, and the trend is towards most commercial employment locating in area type of sources. Therefore, it was decided to project all commercial point sources at the same level throughout the contract period. That is, no growth or decline in employment or emissions.

The above decision was made after examining trends in commercial construction. From the list of point sources, it can be seen that the most recently constructed commercial point source (over 25 tons/year) is Colonie Center (Homart Development Company) constructed in 1965. Such recent commercial ventures as Northway Mall and Mohawk Mall, office buildings such as the new Federal Building, the 855 Central Avenue complex, Executive Park and 50 Wolf Road, and even hospitals such as Leonard are all area sources due to the use of gas, distillate oil, or electric heat, or due to their size. These facilities are as big as anything expected to be built in the Region over the projection period. Therefore, the above assumption that there will be no new commercial point sources appears valid.

COMMERCIAL AREA SOURCE EMPLOYMENT: Data file AIR44AQMA also includes the total change in commercial employment for each TAZ from the base year to 2000. The assumption that commercial point source employment is constant throughout the contract period means that no adjustments in AIR44-AQMA are necessary to account for any changes in point source employment. Therefore, the generation of future year cell level area source commercial employment estimates is:

$$\begin{matrix}\text{Future year} \\ \text{Cell Emp}\end{matrix} = \begin{matrix}\text{(Base year)} \\ \text{(Cell Emp)}\end{matrix} + \begin{matrix}\text{(Cell Emp)} \\ \text{(Chg. to 2000)}\end{matrix} * \text{(\% 2000 chg. to future year)}$$

The % 2000 change to future year is computed as follows using information from Tables 16 and 17 of CDRPC's Report 500-4.

	1975	1980	1985	1995	2000
Total Commercial Employment	215,050	240,300	262,850	303,159	322,000
Point Source Employment	64,185	64,185	64,185	64,185	64,185
Area Source Employment	150,865	176,115	198,665	238,974	257,815
Change Since 1975	0	25,250	47,800	88,109	106,950
% of Yr.2000 Chg.	0	23.61	44.69	82.38	100.00

These calculations were also done by program AIR50 and the results are stored in AIR51.

COMPARISON OF AQMA TO SMSA - Programs TEST, TEST44 and TEST46 are used to obtain AQMA level summations of the data in files AIR51, AIR44-AQMA and AIR46EMP respectively. The outputs of these programs can be used to make comparisons between the AQMA and the SMSA. While these comparisons are not needed for any maintenance analysis, they are interesting and do serve to illustrate the reasonableness of the outputs of the sequence of programs described above. The following table contains these comparisons.

COMPARISONS OF AQMA AND SMSA AREA SOURCE EMPLOYMENT

	1975	1980	1985	1995	2000
AQMA Commercial	130,127	149,226	166,272	196,725	211,029
SMSA Commercial	150,865	176,115	198,665	238,974	257,815
AQMA as a % of SMSA	86.25	84.73	83.69	82.13	81.85
AQMA Industrial	20,155	19,753	19,461	19,237	19,148
SMSA Industrial	29,053	27,841	26,964	26,266	26,023
AQMA as a % of SMSA	69.41	70.95	72.17	73.24	73.58

FUTURE YEAR AREA SOURCE EMISSIONS - CDRPC was originally to use the figures derived above to allocate given area source totals to the cell level. However, NYSDEC has been unable to provide the necessary industrial and commercial area source totals. Therefore, NYSDEC will have to use the data in AIR46EMP and AIR51 to allocate area source emissions. The specific procedure is to take the 1975 SMSA level commercial area source emissions and divide it by the 1975 SMSA level commercial area source employment (150,865). The resulting number is the area source commercial emissions per employee. This number is simply multiplied by the number of commercial employees in each cell for the year desired. This last number is obtained from AIR46EMP for 1975 and from AIR51 for 1980, 1985, 1995 and 2000.

Industrial area source emissions are similarly found by dividing the SMSA level 1975 emissions by 29,053 and using the resulting emissions per industrial area source employee with the appropriate count of area source industrial employees per cell.

In view of the lack of SMSA level area source commercial and industrial emission estimates for the base year, CDRPC feels that data files AIR46EMP and AIR51 complete the requirements of the contract with respect to commercial and industrial space heating emissions.

TRANSPORTATION EMISSIONS

Auto and truck traffic on public roadways accounts for the vast majority of transportation related emissions. However, small amounts of emissions are concentrated at certain airports, railroad yards and the Port of Albany.

PUBLIC ROADWAYS - CDRPC obtained the NYS Department of Transportation's air pollution emission runs for 1975, 1985 and 2000 from the Capital District Transportation Committee. These runs give the emissions for each Traffic Analysis Zone for particulates but not SO_2. A major problem with the data is that the TAZs used for these runs are different from those currently used for planning purposes by CDRPC and CDTC. Therefore, it was necessary to obtain a map of these zones and determine what DOT TAZ each AQMA cell was in. This information is stored as AIR55 which contains DOT TAZ, CDRPC TAZ, cell ID, census tract and MCD for each cell in the AQMA. Data element AIR56 contains the DOT emission data for 1975 and 1985 for each DOT TAZ.

Program AIR57 allocates the particulate emissions to UTM cell, assuming that within a TAZ the emissions are evenly distributed. The program also estimates SO_2 emissions as .3833 of particulate emissions based on Table 3.1.1-1 of AP-42. Interpolation of this data to 1980 and 1995 was done by straight line projections of the emissions from NYS DOT. The output of this process is a data element called AIRAUTOCD.

AIRPORTS - CDRPC report 200-3 Schenectady County Airport Environs Study contains estimates for aircraft emissions from the Schenectady County Airport (CDRPC cells 032051 and 032052) for 1970 and 1990. The limited growth projected for the Schenectady Airport indicates that a straight line projection through these years is reasonable. Therefore, the following emissions should be loaded into the airport's cells.

SCHENECTADY COUNTY AIRPORT AIRCRAFT EMISSIONS (TONS/YEAR)

	1975	1980	1985	1995	2000
Particulates	3.18	3.95	4.73	6.28	7.05
SO_2	2.62	2.66	2.70	2.78	2.82

For the Albany County Airport (CDRPC cells 042040, 042041 and 043040) emissions estimates were prepared using projected operations and fleet mix data prepared as part of the Albany County Masterplan work now underway by Parsons Brinkerhoff Quade and Douglas (PBQ&D), and emission factors from

AP-42. It should be noted that as the masterplan study is still underway some estimates of the future facilities to be available at the airport had to be made, and that the emissions estimates to be prepared as a part of the masterplan study might be different than those estimated by CDRPC. It is expected that in any differences due to facility constraints, CDRPC's estimates would be higher than PBQ&D's.

ALBANY COUNTY AIRPORT AIRCRAFT EMISSIONS (TONS/YEAR)

	1975	1980	1985	1995
Particulates	21.28	23.53	25.99	38.70
SO_2	22.96	25.43	28.77	46.25

There are six other general aviation airports in the AQMA. They are characterized by short (less than 3,000 feet) often unpaved runways and cater to single engine piston aircraft. If it is assumed that each of these airports has 1000 LTO's or 2000 operations a year, the air pollution emissions based on AP-42 would be 20 lbs. of particulates and 14 lbs. of SO_2. Therefore, emissions from these airports were not included in the allocation.

RAILROAD YARDS - CDRPC is unable to obtain the railroad fuel use data necessary to estimate railroad emissions. However, NYS DEC has estimated railroad emissions for Albany, Rensselaer and Schenectady Counties. CDRPC has chosen to allocate these emissions as follows:

ALBANY COUNTY - to the switching yard at Selkirk, CDRPC cells 040018 and 041017. TOTAL EMISSIONS 23.6 Tons Particulates, 53.8 Tons SO_2.

RENSSELAER COUNTY - to the Amtrack facilities in Rensselaer, CDRPC cell 048029. Total Particulates 2.5 Tons, Total SO_2, 5.7 Tons.

SCHENECTADY COUNTY - to the Rotterdam Depot, CDRPC cell 027044. Total Particulates 1.2 Tons, Total SO_2, 2.8 Tons.

Due to changing Federal and State policy towards railroads, it is difficult to project future railroad emissions. Therefore, CDRPC feels that NYS DEC's base year estimates should be used for future contract years until other data becomes available.

PORT OF ALBANY - The Port of Albany is a deep water Port with a channel depth of thirty feet. In 1974, there were 120 reported vessel calls. Using the assumptions on Page 5-23 of USEPA Document APTD-1135 Guide for Compiling a Comprehensive Emission Inventory of a three-day stay and 660 gallons of residual oil per day, the annual fuel consumption is 3 days X 660 gal/day X 120 ships = 237,600 gallons.

Using the emission factor from Table 3.2, 3-1 of AP-42 for SO_2 of 27 lb/1000 gal, annual emissions are 6,415.2 lbs. or 3.2 tons.

For particulates, the emission factor is 1.04 lb/hour so 120 ships X 3 days/ship X 24 hours/day X 1.04 lb/hour = 8,986 lbs. or 4.5 tons/ year.

The Port is located in CDRPC cells 047027, 046026 and 046025. Therefore, the vessel emissions in the Port for each of these cells is 1/3 of the total, or 1.5 tons particulates, 1.1 tons SO_2.

INDUSTRIAL EMISSIONS

Industrial heating emissions are discussed in the section entitled Commercial-Industrial-Institutional Allocations. Base year industrial process emissions are all contained in DEC's AIR100 Emission Inventory File. For future years, these process emissions should be adjusted by the following growth factors based on 2-digit SIC groups. (Source Table 16 of CDRPC Report 5-0-4)

INDUSTRIAL GROWTH FACTORS, CAPITAL DISTRICT AQMA

SIC	1975	1980	1985	1995	2000
20	1.00	.7931	.6345	.4310	.3448
22	1.00	.8226	.7177	.5847	.5323
24	1.00	.9212	.6788	.5546	.5091
27	1.00	1.0204	1.0612	1.1531	1.2041
28, 29	1.00	1.0566	1.1321	1.2677	1.3325
21,23,25,26	1.00	1.0238	1.0476	1.0833	1.0952
30	1.00	.9400	.9000	.7700	.7000
33	1.00	.8750	.7000	.5250	.4500
34	1.00	.9530	.9444	.9037	.8889
35	1.00	1.1837	1.3061	1.4592	1.5306
36	1.00	.8085	.7021	.5851	.5319
37	1.00	.9333	.8666	.8666	.8666
31,32,38,39	1.00	1.0417	1.0694	1.1111	1.1250

INCINERATION EMISSIONS

Incineration emissions are also contained in DEC's AIR100 Emission Inventory File. There is no reason to expect significant changes in incineration emissions over the projection period. Therefore, the data in DEC's AIR100 File should be used for the base and projection years.

POWERPLANT EMISSIONS

The only non-hydro powerplant in the AQMA is Niagara Mohawk's Glenmont facility. Its emissions are included in DEC's Point Source File, and the Facility is expected to remain in operation at its current level throughout the projection period. Therefore, DEC's data should be used for the base and projection years.

APPENDICES

CDRPC PROJECT MEMORANDUM

DATE: JUNE 1975

TYPE OF REPORT: TECHNICAL MEMO

PROJECT TITLE: SMALL AREA FORECAST

PROJECT NO.: 501

FUNDING SOURCE & CONTRACT NO.: "701" Program (CPA-NY-02-00-1039)

CONTRACT PERIOD: October 1, 1974 - June 30, 1975

Capital District Regional Planning Commission
Executive Park Tower
Stuyvesant Plaza
Albany, New York 12203

SMALL AREA FORECASTS

PURPOSE: The purpose of this project is to create 1970, 1980, 1990 and 2000 population and 1970 and 2000 employment (by SIC group) data bases by small areas that are consistent with the large area projections in CDRPC's preliminary Regional Development Plan, a Consultation Document. These data files are to be stored in CDRPC's computer facilities for use in future projects.

SMALL AREA: The first task was the choice of an appropriate "small area". Ideally, this would be a neighborhood no larger than a 1 km by 1 km UTM grid cell. Data at this level could be aggregated to any desired level for use. However, neighborhoods usually do not have well defined boundaries. Additionally, the smallest level for which substantial base year (1970 or 1973) data is available is the Traffic Analysis Zone (TAZ). TAZ's have the desirable traits of being smaller than any other common statistical unit (e.g. minor civil division or census tract), having boundaries that do not cross the boundaries of other common statistical units, having a degree of homogony in a given TAZ (i.e. approximating artificial neighborhoods) and of being smaller than a 1 km by 1 km UTM grid cell in urban areas. In view of these traits, the availability of population, land use and some employment data by TAZ for the base year and the fact that the limited scope of this project precluded generation of substantial amounts of new data, the TAZ was chosen as the small area.

POPULATION: The 1970 population for each TAZ was obtained by adding up the census populations of each block within the TAZ. This work was part of that completed as the background for the RDP, and was not part of this project. The changes between 1970 and the year 2000 for each Minor Civil Division (MCD) were calculated from RDP projections. The apportionment of the MCD level changes to TAZ's was conducted as follows:

The Regional Building Block year 2000 Preliminary Regional Development Plan (the preparation of which is described in CDRPC Technical Report 100-1 Methodology for the Preparation of Regional Development Plan Alternatives) was utilized to find the portion of the expected change for an MCD that a particular TAZ was expected to receive. The Taz was then allocated this portion of the MCD's 1970 to 2000 population change. This quantity was identified as "CHGPOP" (change in population). The use of this proportioning method and CHGPOP rather than the absolute population changes predicted for each TAZ was necessary because the limited number of quantized change possibilities presently allowed by the building blocks resulted in the plan both over and underestimating the year 2000 populations of the different MCD's. However, although the absolute numbers of population change indicated by the building blocks are not correct, the relative proportion of change and type of change for each TAZ are correct. Thus the use of the proportion of change for each TAZ by MCD gives a close estimate of the expected year 2000 population by TAZ.

To find the 1980 and 1990 populations of each TAZ, the rates of population change for each decade for each of the five subregions described in the RDP was determined. The appropriate rate was then applied to the CHGPOP for each TAZ for each decade and the 1980 and 1990 populations obtained. This was completed using the computer program POPJOY attached in the appendix. As indicated in POPJOY, a slight modification of this approach was utilized for the Central Cities Subregion. This is because the Central Cities as a group are expected to lose population between 1970 and 1980, then they are expected to gain population after 1980. However, some TAZ's which are presently overcrowded or in the way of redevelopment, are expected to lose population between 1970 and 2000. Applying the negative growth rate for the Central Cities group to these TAZ's would result in them gaining population between 1970 and 1980. This is not likely to happen, so the 1980 population for each TAZ in the Central Cities Subregion was determined by multiplying the ratio of the Central Cities 1980 population to its 1970 population by each TAZ's 1970 population. The Central Cities 1990 TAZ populations were estimated in the same way as those of the other groups.

The output of this process is a computer element named TOMPOP containing the census tract, TAZ number, 1970, 1980, 1990 and 2000 populations and subregional group number for each TAZ. A copy of the information in this file is in the appendix of this document.

EMPLOYMENT: At the beginning of this project, CDRPC had no employment information by TAZ. Initial attempts to create such a file included running multiple linear regressions of MCD level land use

against MCD level employment. While the correlations obtained were statistically quite good (R-Square = .96, or 96% of the variation in employment was explained by land use), they were not useful as the best predictor of employment at the MCD level was high density residential. Additionally, the constant was a negative number (-147). When the resulting equation was applied to the land use data, many rural towns came out with negative employments. Many modifications to the original regression were tried including doing separate regressions for each subregion and eliminating residential land use as an independent variable. In no case was a good regression obtained that did not result in many TAZ's with negative employment.

The search for an alternative employment file resulted in CDRPC borrowing the Capital District Transportation Committee's file of employment by TAZ by 9 employment groups:

Industrial Groups	SIC Components
1 Agriculture, forestry mining	01-09, 10-14
2 Construction	15-17
3 Manufacturing	19-39
4 Transportation, Communication Utilities	40-42, 44-49
5 Finance, Insurance	60-67
6 Services	70, 72-73, 75-76, 78-82 84, 86, 88-89
7 Government	91-94, 99
8 Wholesale	50, 52
9 Retail	53, 59

This data was not complete. Some of the omissions were: Self-employed people, farmers, small post offices, some employers of less than 25 people, certain school districts, etc. Additionally, the data came with the following conditions:

> The file will be returned when CDRPC has completed its analysis.
> No permanent copies of the file will be made.
> None of the file information will be released or published without NYSDOT approval.

The file was corrected for omissions as follows. The first step was to allocate the self-employed people and unpaid family members. The 1970 census contained information on the number of self-employed persons and unpaid family members by census tract of residence. Since many of these people work at home or in adjacent offices, it was assumed that the number of self-employed people and unpaid family members working in a tract was the same as the number living in the tract. These people were allocated to the TAZ's in each tract on the basis of the population of each tract.

The second step was to allocate farmers according to the amount of agricultural land in each tract. The number of farmers to be allocated was obtained by subtracting the agriculture, mining and forestry employment on the CDTC file from the 1970 agriculture and mining employment from CDRPC Technical Report 500-4, Population, Income and Employment Forecasts for the Capital District Region.

The employment for each school in the omitted school districts were then added to the appropriate TAZ. These employment figures were obtained from CDRPC Technical Report 500-1 School Districts in the Capital District Region.

Having no information on the specific location and number of employees of any other omissions, the following allocation method was utilized.

A) The total file employment for each municipality was obtained by adding up each TAZ in each municipality. This was compared to the MCD level figures in the RDP appendix and the number of employees not reported for each municipality was noted.

B) The total file employment by each of the nine industry groups was computed by addition of each employment group for every TAZ. The 1973 employment by industry was obtained by interpolating between the 1970 and 1980 employment figures in CDRPC Technical Report 500-4 Population. . . . The interpolation was done so that the total of the employments by industry equaled the total of the employments by MCD or 291,630.

C) A computer program was devised which printed out the number of employees per acre of land use for each TAZ and indicated when there was land use with no employment associated with it. The ratios used were:

Commercial employment to commerical land use
Service+government+fincance employment to institutional land use
Manufacturing employment to manufacturing land use
Transportation, Communication employment to transportation land

D) The average uncounted employment per acre of unused land for each type of land use was calculated and this information combined with the total numbers of uncounted employees by group and uncounted employment by MCD was used along with land use information including CDRPC Technical Report 500-2 Shopping Center and Office Building Development in the Capital District Region to manually allocate employment to each TAZ so that the municipal totals and industry group totals for the Region were maintained.

The output of this process was a listing of employment by industry group by TAZ that was consistent with all known data. A sample page of this output with the TAZ and Census Tract identification removed as per our confidentiality agreement with NYSDOT is in the appendix to this document.

For the year 2000, CDRPC has MCD level employment projections and Regional level industry group employment projections as well as UTM grid cell building block change information. In this case "CHGEMP" (change in employment) was calculated for each industry

and each MCD. The building block changes were apportioned to each TAZ in an MCD as in the population work. Once this was completed, the Regional employment by industry group in the file was computed by addition of the number in each TAZ and differences between the industry totals from CDRPC Technical Report 500-4 Population. . . and those in the projected file were rectified by a manual correction process that maintained the correct MCD level employment totals.

There are no MCD level employment projections for 1980 or 1990. These will be developed from the 1970 and 2000 employment files generated by this project.

CHANGES DUE TO MULTIPLE CELL TAZ's

TAZ	IS INCLUDED IN TAZ
10002	10000
10010	10000
10011	10000
10012	10000
10020	10013
10030	10032
10031	10032
10040	10051
10041	10051
10042	10120
10043	10051
10044	10120
10045	10051
10050	10051
10053	10051
10060	10001
10061	10001
10062	10070
10110	10055
10111	10120
10112	10151
10130	10132
10131	10132
10150	10055
10171	10170
10172	10137
10210	10203
10310	10306
10392	10391
10703	10701
10704	10700
11006	11000
11100	11101
11104	11107
11105	11107
20010	20012
20011	20012
20013	20012
20031	20032
20051	20033
20060	20030
20070	20071
20074	20075
40001	40000
40010	40000
40020	40000
40031	40021
40034	40033
40035	40033
40036	40032
40041	40040
40042	40040
40043	40040
40050	40040
40051	40052
40060	40040
40061	40040
40062	40064
40063	40064
40065	40064
40066	40064
40067	40064
40071	40073
40091	40094
40092	40094
40093	40094
41010	41011